

REMARKS/ARGUMENTS

Favorable reconsideration of this application, in view of the present amendment and in light of the following discussion, is respectfully requested.

Claims 1-5, 7-22, and 24-58 are pending. In the present amendment, Claims 1, 7, 8, 18, 30, 53, 54, and 57 are currently amended and Claim 6 is canceled without prejudice or disclaimer. Support for the present amendment can be found in the original specification, for example, at page 24, line 1 to page 26, line 12 and in Figures 1, 2, 3, and 4. Thus, it is respectfully submitted that no new matter is added.

In the outstanding Office Action, Claims 1, 2, 8, 18, and 54 were rejected under 35 U.S.C. § 103(a) as unpatentable over Schuppich et al. (U.S. Patent No. 7,247,276, hereinafter “Schuppich”) in view of Matsubayashi et al. (U.S. Patent No. 6,103,411, hereinafter “Matsubayashi”); Claims 3, 4, and 5 were rejected under 35 U.S.C. § 103(a) as unpatentable over Schuppich in view of Matsubayashi, and further in view of Thies et al. (U.S. Patent No. 6,736,983, hereinafter “Thies”); Claims 18, 30, 31, 33-35, 53, and 57 were rejected under 35 U.S.C. § 103(a) as unpatentable over Kearl (U.S. Patent No. 6,828,055) in view of Bae et al. (U.S. Publication No. 2002/0169077, hereinafter “Bae”) and Matsubayashi; Claim 32 was rejected under 35 U.S.C. § 103(a) as unpatentable over Kearl, Bae, and Matsubayashi, and further in view of Lambert (U.S. Patent No. 5,139,648); and Claim 32 was rejected under 35 U.S.C. § 103(a) as unpatentable over Kearl, Bae, and Matsubayashi, and further in view of Wang et al. (U.S. Publication No. 2003/0116503, hereinafter “Wang”).

In response to the rejections under 35 U.S.C. § 103(a), Applicants respectfully request reconsideration of these rejections and traverse these rejections, as discussed below.

Amended Claim 1 recites:

A microreactor for obtaining hydrogen gas by reforming a feed material, comprising:

a metal substrate having a microchannel portion on one surface thereof,

an insulating film formed on an other surface of the metal substrate where the microchannel portion is not formed,

a heater provided on the insulating film on the other surface of said metal substrate such that a front surface of the heater contacts the insulating film and a back surface of the heater includes a heater protective layer that covers said heater while exposing only electrodes extending from the back surface of the heater, the electrodes being configured to energize the heater,

a catalyst supported on said microchannel portion, and

a cover member having a feed material inlet and a gas outlet and joined to said metal substrate so as to cover said microchannel portion to form a single continuous flow path, wherein the feed material inlet and the gas outlet are substantially perpendicular to axial directions of the single continuous flow path.

Accordingly, in the microreactor cited in Claim 1, a heater is provided on the insulating film which is located on the other surface of a metal substrate where the microchannel portion is not formed. As can be seen in the exemplary embodiment shown in Figure 2, the heater also includes electrodes on a back surface of the heater and the heater is surrounded by a protective layer. However, the protective layer only exposes the electrodes extending from the back surface of the heater. It is respectfully submitted that the cited references do not disclose or suggest every feature recited in amended Claim 1.

Schuppich describes microreactors connected in parallel that include a plurality of fluid guidance plates 1 having an open channel at a top and a bottom thereof.¹ Schuppich also describes that the fluid guidance plates 1 can be cooled or heated from their rear side by a heat transfer medium that includes a flowing liquid or gas for heat exchange.² The Office Action, on page 3, equates reference numeral 23 from Figure 2 of Schuppich to the claimed

¹ See Schuppich, at column 3, lines 1-13 and in Figures 1-3.

² See Schuppich, at column 5, line 57 to column 6, line 10.

insulating film. However, reference numeral 23 of Schuppich refers to heat transfer channels and not an insulating film.³ Additionally, the Office Action relies on Matsubayashi to modify the heater of Schuppich to be provided on a side where the microchannel portion is not formed.

However, it is respectfully submitted that this combination does not disclose or suggest “a heater provided on the insulating film on the other surface of said metal substrate such that a front surface of the heater contacts the insulating film and a back surface of the heater includes a heater protective layer that covers said heater while exposing only electrodes extending from the back surface of the heater, the electrodes being configured to energize the heater,” as recited in amended Claim 1.

Instead, as discussed above, Schuppich describes that the fluid guidance plate is heated or cooled by a heat transfer medium that includes a flowing liquid or gas for heat exchange. Thus, the heater described in Schuppich would not include electrodes configured to energize the heater located on the back of a heater which is located on the insulating film on the cover. Further, Schuppich does not disclose or suggest the claimed insulating film. Additionally, Schuppich is silent with regard to a protective layer that covers the heater while only exposing electrodes thereof. Further, as the heater described in Matsubayashi also uses flowing fluid to transfer heat, Matsubayashi does not cure the above-noted deficiencies of the heater of Schuppich. Therefore, the heater described in Schuppich as modified by Matsubayashi is not the claimed heater.

Accordingly, it is respectfully submitted that Claim 1 patentably defines over Schuppich in view of Matsubayashi. Thus, it is respectfully requested that the rejection of Claim 1, and Claim 2 which depends thereon, as unpatentable over Schuppich in view of Matsubayashi be withdrawn.

³ See Schuppich, at column 5, lines 65 and 66.

Further, independent Claims 8, 18, and 54, while each directed to an alternative embodiment, recite features similar to those discussed above with respect to Claim 1. Accordingly, it is also respectfully requested that the rejection of Claims 8, 18, and 54 as unpatentable over Schuppich in view of Matsubayashi be withdrawn.

Regarding the rejection of Claims 3, 4, and 5 as unpatentable over Schuppich in view of Matsubayashi, and further in view of Thies, it is noted that Claims 3-5 depend on Claim 1 and thus are believed to be patentable for at least the reasons discussed above with respect to Claim 1. Further, it is respectfully submitted that Thies does not cure the above-noted deficiencies of Schuppich and Matsubayashi. Accordingly, it is respectfully requested that the rejection of Claims 3-5 be withdrawn.

Amended independent Claim 18 recites:

A microreactor for obtaining hydrogen gas by reforming a feed material, comprising:

a joined body comprising a metal substrate provided with a microchannel portion on one surface thereof, and a metal cover member having a feed material inlet and a gas outlet and joined to said metal substrate so as to cover said microchannel portion to form a single continuous flow path, the single continuous flow path formed by said microchannel portion located inside said joined body and said metal cover member, a catalyst supported on a whole inner wall surface of said flow path, an insulating film formed on an other surface of the metal substrate where the microchannel portion is not formed, and a heater provided on the insulating film on the other surface such that a front surface of the heater contacts the insulating film and a back surface of the heater includes a heater protective layer that covers said heater while exposing only electrodes extending from the back surface of the heater, the electrodes being configured to energize the heater,

wherein the feed material inlet and the gas outlet are substantially perpendicular to axial directions of the single continuous flow path.

It is respectfully submitted that the cited references do not disclose or suggest every feature recited in Claim 18.

Kearl describes a fuel stack 22 including bipolar plates 10 and end plates 11 located at the extremities of the fuel cell stack 22.⁴ Kearl also describes that unlike bipolar plates 10 that comprise flow channels on both faces of the plate, the end plates 11 comprise a substantially planar face 13 and a flow face 15 comprising flow channels.⁵ As can be seen in Figure 2A, the end plates 11 include structural backing plates 66 on the substantially planar face 13.

The Office Action, on page 7, equates the anode and cathode 30, 32 of Kearl to the claimed heater. However, as can be seen clearly in Figure 2A of Kearl, the anode and cathode 30 and 32 are not positioned on the substantially planar face 13 of the end plates 11. On the contrary, the anode and cathode 30, 32 are positioned on a face of the bipolar plates 10 that comprises flow channels.

Further, Kearl describes a resistive element 56 that can heat the bipolar plate 10.⁶ Thus, the resistive element 56 is positioned on a face of the bipolar plates 10 that comprises flow channels.⁷

The Office Action, also on page 7, modifies Kearl to include the microchannels described in Bae. Additionally, on page 8, the Office Action acknowledges that “Kearl and Bae . . . does not specifically teach that the heater element is on the side where the microchannel portion is not formed.” Instead, the Office Action relies on Matsubayashi to cure this deficiency of Kearl and Bae.

However, it is respectfully submitted that the cited combination does not disclose or suggest “a heater provided on the insulating film on the other surface such that a front surface of the heater contacts the insulating film and a back surface of the heater includes a heater protective layer that covers said heater while exposing only electrodes extending from the

⁴ See Kearl, at column 15, lines 41-50 and in Figures 2A and 2B.

⁵ See Kearl, at column 15, lines 50-57.

⁶ See Kearl, at column 10, lines 27-32.

⁷ See Kearl, at column 10, lines 20-24.

back surface of the heater, the electrodes being configured to energize the heater,” as recited in amended Claim 18.

Instead, as discussed above, the heater described in Matsubayashi is not the claimed heater. Further, as previously discussed, the anode and cathode 30, 32 of Kearl are not provided on a surface that does not contain flow channels and neither is the resistive element 56. Additionally, none of the heaters described in any of the cited references disclose or suggest electrodes positioned on a back surface of the heater that are configured to energize the heater and that these electrodes are exposed through a heater protective layer that covers the heater. Therefore, the heater described in Kearl as modified by Bae and Matsubayashi is not the claimed heater.

Accordingly, it is respectfully submitted that the cited combination does not disclose or suggest every feature recited in amended Claim 18. Thus, it is respectfully requested that the rejection of Claim 18 as unpatentable over Kearl in view of Bae and Matsubayashi be withdrawn.

Independent Claims 30, 53, and 57, while each directed to an alternative embodiment, recite features similar to those discussed above with respect to Claim 18. Therefore, it is respectfully submitted that Claims 30, 53, and 57 also patentably define over Kearl in view of Bae and Matsubayashi. Thus, it is respectfully requested that the rejection of Claims 30, 53, and 57, and Claims 31 and 33-35 which depend on Claim 30, be withdrawn.

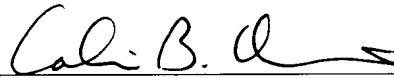
Regarding the rejections of Claim 32, it is noted that Claim 32 depends on Claim 30, and thus is believed to be patentable for at least the reasons discussed above with respect to Claim 30. Further, it is respectfully submitted that neither Lambert nor Wang cure the above-noted deficiencies of the combination of Kearl in view of Bae and Matsubayashi with respect to Claim 30. Thus, it is respectfully submitted that Claim 32 patentably defines over the cited

combinations of references. Therefore, it is respectfully requested that the rejections of Claim 32 be withdrawn.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. A Notice of Allowance is earnestly solicited.

Respectfully submitted,

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